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STUDY OF THE EFFECTIVENESS OF SOME CHELANT AGENTS FOR THE REMEDIATION OF THE MERCURY CONTAMINATED SOIL FROM ALMADEN

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Scientific Topic: Environmental Technology; Soil Remediation.

In most of the in-situ remediation technologies for heavy metal contaminated soil the use of an extractant agent is usually needed. Therefore, the corresponding feasibility studies of each technological alternative should include the selection of the most suitable agent. This work studies the effectiveness of some chelant agents (thiosulfate, EDTA, iodide and HNO_3) for the remediation of the mercury contaminated soil from Almaden mining district (Ciudad Real, Spain).

The kinetic study was performed in batch extraction assays to determine both the adequate extractant agent and its optimal concentration. The extractants tested were NaCl (0.01 M and 0.1 M), EDTA (0.01 M, 0.1 M and 1 M), HNO_3 (0.01 M and 0.1 M), KI ($5x10^{-3}$ M, 0.01 M, 0.1 M and 1 M) and $Na_2S_2O_3$ (0.01 M, 0.1 M and 1 M).

In addition, the fractionation of the mercury species by the sequential extraction technique based on the method from BCR (Bureau Communautaire de Référence) was also carried out in the initial soil and in the sample corresponding to the equilibrium of each extractant agent. This procedure provides four fractions, which from higher to lower mobility are: weak acid soluble (WAS), reducible, oxidizable and residual.

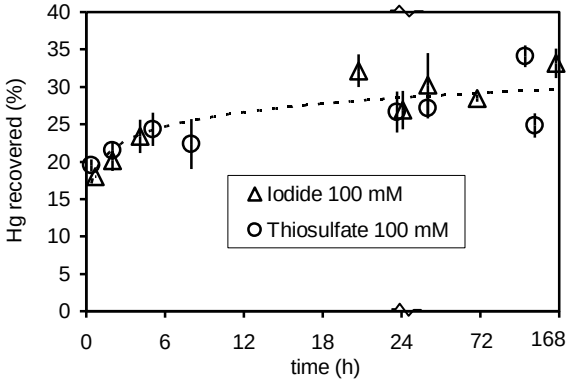

Figure. Comparison between the kinetic of the extraction of Hg with the iodide solution and with the thiosulfate solution**.**

The results indicate that iodide and thiosulfate and the 1 M solution of EDTA yield the best mercury removal percentages among the 5 chelants tested. The lower EDTA concentration solution and chloride solution extracted at most a 2% of the initial concentration of Hg in the soil. No mercury was extracted by the nitric acid solution. As can be seen in the figure, the equilibrium is reached within the first 24 hours and about 30% of the initial mercury was removed from the soil when iodide and thiosulfate solutions are used.

The distribution of the Hg species in the soil after the iodide extraction is different from that obtained with the thiosulfate extraction. Comparing with the results from the initial soil, the weak acid soluble fraction in the soil after each treatment is much higher than before treatment. This may result in an increase of the environmental risks because this is the most mobile fraction (Subirés-Muñoz et al., 2011).

After the evaluation of the best extractant agent for the remediation, we have explored its possible application for soil flushing. When iodide is used as chelating agent in the flushing experiment, a 35% of the mercury can be removed and the speciation results were similar to the ones obtained in the batch experiments. The next flushing experiment will study the removal of mercury with thiosulfate solution as extractant agent.

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